Introduction to the Special Issue on the 2004 IEEE International Symposium on the Physical and Failure Analysis of Integrated Circuits (IPFA)

THIS special issue of IEEE TRANSACTIONS ON DEVICE AND MATERIALS RELIABILITY covers selected papers from the IEEE International Symposium on Physical and Failure Analysis of Integrated Circuits (IPFA) 2004 held in Hsinchu, Taiwan, R.O.C. Eight papers from the IPFA2004 conference covering the areas of failure mechanisms in high-κ dielectrics and thin gate dielectric breakdown, failure mechanisms in Cu and low-κ dielectrics, reliability and failure mechanism study of RF transistors, and low-voltage and high-speed memory devices, and issues related to new device packages are included in this special issue. Since the IPFA conference focuses on the latest trends in failure analysis in devices and packages to understand the process and product issues for device yield and reliability improvement, the topics covered are of interest and relevant to semiconductor device professionals.

In the area of device and interconnect failure analysis and reliability, six papers covering a wide range of topics are included. The first paper deals with the physical and reliability characteristics of Hf-based gate dielectrics on strained-SiGe MOS devices while another paper discusses on the hot carrier reliability of the HfSiON dielectric with metal gate. The third paper reports the effect of hot-carrier induced degradation on the RF performance of SiGe heterojunction bipolar transistors. Structural damages and post-breakdown performance of small transistors associated with breakdown in ultra-thin gate oxide stressed at very low voltage are presented in the fourth paper. Two papers dealing with the electromigration and corrosion study of copper dual damascene technology are included.

To cover the area of package failure and reliability, a paper describing the interface microstructural evolution of lead-free solder in bump metallization technology during reflow and high-temperature stress is presented. This special edition is concluded by a paper on a reliability study of a slow programming issue in advanced low-voltage and high-speed ferroelectric memory devices.

By including these eight papers covering a broad area of device failures and reliability aspects, this special issue is intended to bring the attention of readers to some of the latest trends in integrated circuit/package failure analysis, as well as to the symposia covering such trends in a broad spectrum.

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